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ABSTRACT

Over the past several years, technical communicators have been struggling to change some of the stylistic traditions inherited from scientific discourse. Rhetoricians, writing teachers, and psychologists all agree that the use of analogy and first- or second-person sentence construction make for more effective communication than the absence of analogy and the use of the impersonal third person. However, established conventions and standards sometimes preclude inserting these stylistic devices into our material. With only an intuitive feel for the use of language, our arguments lack the substantive basis with which to change the standards. In order to examine the discrepancy between theory and practice, an experiment with computer documentation was conducted to measure the effects of analogy and second-person construction in learning, and another to assess whether these same stylistic devices were annoying to subject matter experts. The use of analogy made it easier for subjects to recall information without being cued; however, it had no effect on cued recall (recognition). Computer programmers were indifferent to the use of analogy (not hostile), and they preferred the second person sentence construction to the third person. (Author/JB)

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Preliminary Report: A Study of Analogy and Person in Computer Documentation

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Analogy and Person Within Literature

The Past: What Rhetorical Theory and Psycholinguistics Say About Analogy

Rhetoricians since classical times have preached the value of consciously and skillfully varying the stylistic components of communication to fit the occasion. Among the stylistic components cataloged by Aristotle, analogy appears as a particularly effective "trope." Tropes, as opposed to schemes, do not operate on the meter, rhythmic balance, or flow of material. Rather, they work through a turn of meaning, by drawing parallels or contrasts between new and perhaps unfamiliar material and similar, familiar concepts already within the listener's or reader's repertoire.

In this way, rhetoricians and modern communicators hypothesize, new material is more easily learned, as the student, reader, or listener simply attaches the new material to an existing conceptual framework. The lengthy process of building a new framework for new knowledge is bypassed by this "priming" process.

As psycholinguists hypothesize, the integration of new knowledge into long-term memory is hastened by this priming process, by evoking existing networks of knowledge into which new concepts can be integrated. Clark and Clark (1977) discuss what they call the Given-New Strategy of communication. If information is presented in this optimum manner, relating each piece of new information to a piece already within the receiver's memory, comprehension will proceed smoothly and quickly. If there is no match between given and new, according to the Congruence Principle, it will take extra processing time to either reject the information or construct the bridging inferences.

Not only is learning easier, but retrieval of new material from memory is aided when the new concepts are attached to common, or densely connected concepts. According to Thorndyke (1977), we will be able to remember those facts or propositions that are central or at a high level within the knowledge (memory) hierarchy. In his experiments Thorndyke presented subjects with four different story conditions. In one condition the subjects received a passage with a theme statement at the beginning of the passage. This theme statement acted as an advance organizer, or in other words, it alerted the reader as to what to expect. The reader was then able to use an elicited framework and attach new propositions in the appropriate spots.

In the next condition the theme statement was presented at the end of the passage. The reader supposedly would have to proceed through the material, searching for a relevant framework in memory and building a new one if the searches were unsuccessful. At the end of the material, upon reading the theme statement, the reader could conceivably go back and rearrange the remembered propositions within the elicited framework. However, we would expect the cognitive load in this condition to be greater than that in condition 1.

Condition 3 consisted of the passage with no theme statement, so the cognitive load would be similar to that in condition 2. However, in this case, the reader would be left with whatever sense was made of the material during the reading task. Condition 4 had the sentence order randomized, thereby violating the sequencing of propositions and confounding the reader's ability to generate any framework at all.

Thorndyke found that recall of facts was highest when subjects received the theme statement at the beginning of the passage. Additionally, recall was better with the After-theme condition than with the No-theme condition. Of course, recall was poorest when sentence order was randomized

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We assume that the use of analogy as an advance organizer offers a particularly effective way to minimize the cognitive load demanded when learning new material. Through using apt analogies we can offer to the reader familiar anchoring concepts for unfamiliar ideas.

The Past: What Traditions in Scientific Communication Say About Person

Writing teachers have for many years been teaching that using the first person "I" and second person "you" makes for clearer writing than using the third person "he, she, it, the user." Evidently, being addressed directly and unambiguously precludes the rotation of viewpoint that we must make when reading, for instance, that "the user must press ENTER."

Within every discipline, however, conventions and standards govern much of what is written and published. Those within the domain become accustomed to literature written in the "accepted" style and seem resistant to any variations (not only in theme but in style). Despite the fact that cognitive psychologists and writing teachers have been teaching that human beings read more easily material that is in active voice and first or second person, the conventions within some disciplines will not accept material presented in such a manner.

Traditionally, scientific communication has held to passive voice and third person stylistic conventions. The objectivity required by the scientific method for studying nature has carried over to a tradition of language usage that attempts to sterilize the human element from the report. However, there is no longer a consensus that says that this is necessary or even desirable.

The reporting stage within a scientific endeavor is aimed at communicating and disseminating knowledge, even at persuading readers and listeners. Michael Halloran goes so far as to posit that much of Watson and Crick's success in presenting their revolutionary views on the structure of DNA hinged on their very personal and revolutionary use of language within their field. Their scientific papers and manuscripts were written in first person, active voice, and used many analogies and examples. The language did not obfuscate, but rather, it truly explained and communicated.

There are many who are still steeped in the tradition, however. Not more than a few years ago, a certain professor was told to revise a manuscript, deleting all the direct references to the reader and himself; in other words, he had to re-write the manuscript in third person, passive voice.

The Present: Analogy and Person in Informative Communication

Up to this point, we have discussed analogy with no reference to the appropriateness or concentration of usage within material. In line with theory, the effectiveness of an analogy depends upon its appropriateness for the targeted audience. The anchoring concept must be something that is indeed familiar to the audience. To effectively communicate, the content of the analogy must also not be offensive to the audience, unless the intent is to antagonize. Seldom, probably never, should this be the intent in scientific communication.

Educators and practitioners have been worrying about the antagonism that could be created by anthropomorphizing computers. Some industries have gone so far as to forbid the use of the term "memory" for processor storage within a computer. We would agree that there is a fine line to be drawn between desirable, tasteful analogies and undesirable or overworked ones. We are not bothered by this particular analogy (memory) and might argue for the use of a term such as "engine" to replace jargon such as "processing control element" or "computer element complex."

While we agree that computers should not be portrayed as human beings, we feel that language, learning, and technology have always been intertwined. Technological advances build upon preceding technology: language and the content of analogies reflect the changing technology. We remember from our biology classes that mitochondria were called the "powerhouse of the cell." Powerhouse was an analogy built upon the industrial revolution. Today, RNA is referred to as a computer tape: the program is simply copied from the tape (RNA) to the new cellular matter (protein). This analogy reflects the new technology just as language has always done so.

An Empirical Study of Analogy and Person Within Computer Documentation

Traditionally, computer documentation mirrored the conventions within scientific discourse: objective use of language, passive voice, third person construction, no analogies to commonplace items. This is changing and is no longer the rule, although the struggle to insert stylistic components to aid human comprehension and lead to readability is ongoing.

We have a rich history and an intuitive feel for the use of language from which to draw in this struggle. However, there has been little quantitative research to study or support this intuitive expertise. Our pilot study could serve to fill this gap and to inspect our hypotheses.

Hypotheses

We started out with the following hypotheses:

Main Effects on Comprehension:

1. Comprehension as measured by recognition will be higher than comprehension as measured by recall (across all stylistic versions).

   This we know from prior educational research. This would also seem to be intuitively evident since cued retrieval should be easier in any case than retrieval that is not cued.

2. Analogy will increase readers' comprehension (over no analogy).

3. Second person construction will increase readers' comprehension (over third person).

Interaction Effects on Comprehension:

4. Analogy will have a much stronger effect than person on comprehension. In other words, in the analogy condition, there will be no significant difference in comprehension between the second and third person conditions. (The effect of analogy will override the effect of person.)

5. The difference in recall scores between the analogy and the no analogy conditions will be greater than the difference in recognition scores between the two conditions. In other words, while both recognition and recall will improve through using analogies, they are more important for recall than for recognition.

   We believe that by connecting new concepts to familiar, densely connected concepts in the reader's memory, the chances of successfully retrieving new information without being cued are greatly increased. Thus analogies will be extremely effective for non-cued retrieval.

6. Second person construction will not have a greater effect on recall than on recognition. In other words, both recall and recognition will be improved to a similar extent.

Main Effects on Preference:

7. Analogy will be preferred.

8. Second person construction will be preferred.

Experimental Design

Four Versions of Computer Documentation (Varying Analogy and Person)

In order to test our hypotheses, we developed four versions of computer documentation covering the same conceptual content:

Version 1 = analogy and second person.

Version 2 = analogy and third person.

Version 3 = no analogy and second person.

Version 4 = no analogy and third person.

We attempted to vary *only* analogy and person in these versions and, thus, to control for extraneous variables that could affect comprehension and preference. Figure 1 shows the difference between versions on several dimensions such as word count and readability levels.

	Version 1	Version 2	Version 3	Version 4
# lines	102	108	105	107
Grade Level *	9.2	9.2	9.6	10.0
Cloudiness Count **	1.7	1.7	4.0	3.9
Flesch Index ***	64.0	62.0	62.0	60.0
Fog Index	12.5	12.6	13.4	13.5
Kincaid Index	9.0	9.5	9.4	9.9
Syllables per word	1.5	1.5	1.5	1.5
Words per sentence	19.2	19.7	19.3	20.1
# words	977	1007	1006	1045
# prepositions	133	132	144	143
# conjunctions	61	61	64	65
# sentences	51	51	52	52
# syllables	1420	1480	1489	1563
# abstracts	7	7	25	25
# passives	10	10	15	16
Acronyms	RETURN ENTER	RETURN ENTER	RET ENT LU SWR	RET ENT LU SWR

* Grade Level: 9.2–10.0 all fall within the "Operators" range.

** Cloudiness Count: 1.7 is "Easy"; 3.9 and 4.0 are "Fairly Easy."

*** Flesch Index: 64.0–62.0 all fall within the "Standard" range.
60.0 falls within the "Difficult" range.

Figure 1. Comparative Data on the Versions of Computer Documentation

All versions present the gist of the content in the same order and explain the following basic computer concepts and devices:

- display screen
- keyboard
- moving to a new line
- moving the contents of the display up and down
- entering material into storage
- saving material in files (data sets)
- split screen capability
- terminal's relationship to parent computer
- computer networks
- sign-ons
- sign-offs
- networking function

In versions 1 and 2, analogies are used to tie the new concepts to what we thought were concepts that an average person would know:

typewriters, windows, pages, dead sea scrolls, filing cabinets, airlines, railroads, *The Arabian Knights* story, secret code words. Aside from using these items in extended analogies, we also retained words like ENTER and RETURN for function keys. When explaining the split screen capability, we used the word "quadrant," which could evoke the image of a cartesian-coordinate graph.

In versions 3 and 4 we did not use any extended analogies. We also used ENT and RET for function key labels, as the words themselves could be construed as analogies. When explaining the split screen capability, we used the word "quarter."

The four versions are included in "Appendix A. Documentation."

Two Comprehension Tests (Recall and Recognition) and One Preference Test

To test for comprehension, we developed two questionnaires: one to measure recall and the other to measure recognition. Because of the different wording in the versions, we had to vary the wording in the questionnaires accordingly. Questionnaires 1a and 1b are the recall questionnaires. They differ only in one word: 1a speaks of "files" while 1b speaks of "data sets." Questionnaires 2a and 2b are the recognition questionnaires. They ask for the same concepts but in the different terminology, for instance 2a asks the meaning of "port hole" while 2b asks the meaning of "LU-to-LU connection" (two terms for the same concept). The questionnaires are included in "Appendix B. Questionnaires."

To test for preference, we developed a sheet asking the respondent to rank order the four versions according to preference. This sheet is also included in "Appendix B. Questionnaires."

Format of Experiment #1 (Comprehension): 2 x 2 x 2 Factorial

We used a 2 x 2 x 2 factorial design to test for the effects of analogy and person on comprehension as measured by the two forms of questionnaire. Thus, recall and recognition measures were treated as experimental conditions also, so that we could see if indeed the type of comprehension is differentially affected.

Figure 2 shows our design.

In order to test for the effect of analogy and person on comprehension of this basic material, we needed to control for prior knowledge. For our first pre-test, we selected a freshman class and a continuing-education class, both at SUNY-Albany. One of the authors administered the test at both classes. Students who had prior experience or knowledge of computers were asked not to participate.

Each student was given one version of the material and one version of the questionnaire. One of the authors handed out the material to the pre-selected students in alternating order, in an attempt to get an equal number of subjects per cell. Following each version was another passage of material administered as an intervening task. Students were directed to read the material in their packet (in sequential order) at the beginning of class. As they finished reading, the material was collected. Students were directed to keep the envelope that was attached to the versions. Just before the end of class the students were directed to complete the questionnaire contained in the envelope. The author then collected the completed questionnaires. (Classes were 2-1/2 to 3 hours long, so this was a delayed post-test.)

The questionnaires were scored by the authors on the following scale: 0 = incorrect, 1 = partially correct, 2 = completely correct. We coded the data with dummy variables in order to be able to use a regression procedure to analyze the effects of the main factors and the interactions between the main factors.

Format of Experiment #2 (Preference): 2 x 2 x 4 Factorial

We used a 2 x 2 x 4 factorial design to test for the effects of analogy and person on preference. Since each of the subjects in this design would be looking at *all four versions*, we controlled for the effect of order by distributing the versions in four different orders. (The last version read might seem easiest because of increased familiarity with the material from reading the prior versions. Or, just the opposite, it might seem obnoxious because of reading similar content three times already.)

The order conditions were as follows:

Order 1 = Version 1, version 2, version 3, version 4

Order 2 = Version 2, version 4, version 1, version 3

	SECOND PERSON		THIRD PERSON	
	Recall	Recognition	Recall	Recognition
ANALOGY	4	4	4	4
NON-ANALOGY	4	4	4	4

Figure 2. Number of Subjects per Cell for First Comprehension Pre-test

Order 3 = Version 3, version 1, version 4, version 2

Order 4 = Version 4, version 3, version 2, version 1

Note: Each version occupies first, second, third, and fourth places in one of the order conditions.

With Experiment #1, we wanted to test for comprehension, so we had to control for prior knowledge and test people who would be called "naive users" within the computer industry. Our interest was in testing for the effect of analogy and person on *learning*. In Experiment #2, however, we wanted to look at the preference of experts within the field, people steeped in the traditional conventions within this area of discourse. Some have argued that, while analogy and second person might be better for naive users, it is not preferred by highly sophisticated users, even when these users are reading outside their field or sphere of knowledge. Perhaps their education has lead them to feel that clear writing is somehow an insult; they want to be challenged to understand. However, we would argue that level of knowledge does not change human cognitive processes. Anyone reading beyond their field of expertise is a naive user. What constitutes an apt analogy might change with different audiences, but the effectiveness of analogy in general as a stylistic aid to comprehension should not.

One of the authors administered the preference test to 14 computer programmers within a particular company. This was a convenience sample, administered to programmers who happened to be in their offices when the author stopped by. Twelve of the 14 programmers completed the questionnaire and reported their preference rankings over the phone to the author the next day. Figure 3 shows the number of subjects per order condition.

We coded the data with dummy variables so that we could use a regression procedure to analyze the effects of the treatments and the interactions between those treatments and the order placement. Figure 4 shows how we blocked the coding.

Results

Discussion

Our first experiment tested the first six of our hypotheses (all but those involving preference). We found the following:

1. Comprehension scores were significantly higher for subjects given recognition tests than for those given recall tests (see Figure 5). Thus our first hypothesis was supported.

2. Using analogies increased our subjects' comprehension scores overall (see Figure 5). Thus our second hypothesis was supported.

3. Second person construction did not seem to affect our subjects' comprehension significantly (see Figure 5). Thus our third hypothesis was not supported.

4. As with our finding of no main effect of person on comprehension, we also did not find a two-way interaction effect of person

	Order 1	Order 2	Order 3	Order 4
Number of Subjects	3	3	3	3

Figure 3. Number of Subjects per Cell for First Preference Pre-Test

on aggregate comprehension in the analogy condition (see Figure 6).

However, notice that subjects tested for recall in the analogy condition scored quite a bit higher when their documentation was in written in second person than when it was written in third person (see Figure 7). The results are not significant at the $p = .05$ confidence level, however, this could be a result of the small sample size in this pre-test. We intend to look more closely at this during our full test. These results would seem to imply that our original hypothesis is incorrect. That is, analogy does not override the effectiveness of person. Thus, our fourth hypothesis was not supported.

5. The difference in recall scores between the analogy and the non-analogy conditions were greater than the difference in recognition scores between the two conditions (see Figure 8), but they failed to differ enough to reach statistical significance. However, with this small pre-test the findings look promising and we will certainly study the matter further in our full test. Note also the differences shown by the three-way interactions in Figure 7.

6. Second person construction did not show an effect on comprehension scores, aggregated from recall and recognition tests (see second hypothesis). Neither did we find any differential effect when we looked separately at second person's effect on recall and on recognition (see Figure 9). Because there is no effect shown, it appears that our sixth hypothesis was supported. However, we cannot truly conclude that this is so. Because comprehension did not seem to be affected by second person at all, we could not truly test our sixth hypothesis.

7. Programmers seemed to be indifferent to the use of analogy overall (see Figure 10). Therefore, our seventh hypothesis was not supported.

8. Programmers preferred texts written in second person over those written in third person (see Figure 11). Therefore, our eighth hypothesis was supported.

Conclusions

Pragmatically speaking, the most interesting finding from our first experiment is that the use of analogy in computer documentation could make it easier for users to recall information. We believe this is important, for much of computer usage is dependant upon recall, not recognition. Users generally are happier with a system when they do not have to continually consult documentation in order to perform a task. In command driven systems, recall is especially important.

Our second experiment was designed to test the argument that highly skilled computer users do not like documentation that employs analogy. While we did not find a strong preference for analogy, neither did we find any objection to it.

It is interesting to note that the order effect was highly significant (see Figure 11). That is, programmers tended to prefer the first version they saw. This implies that programmers, as a class, are not strongly attached to any one style of writing.

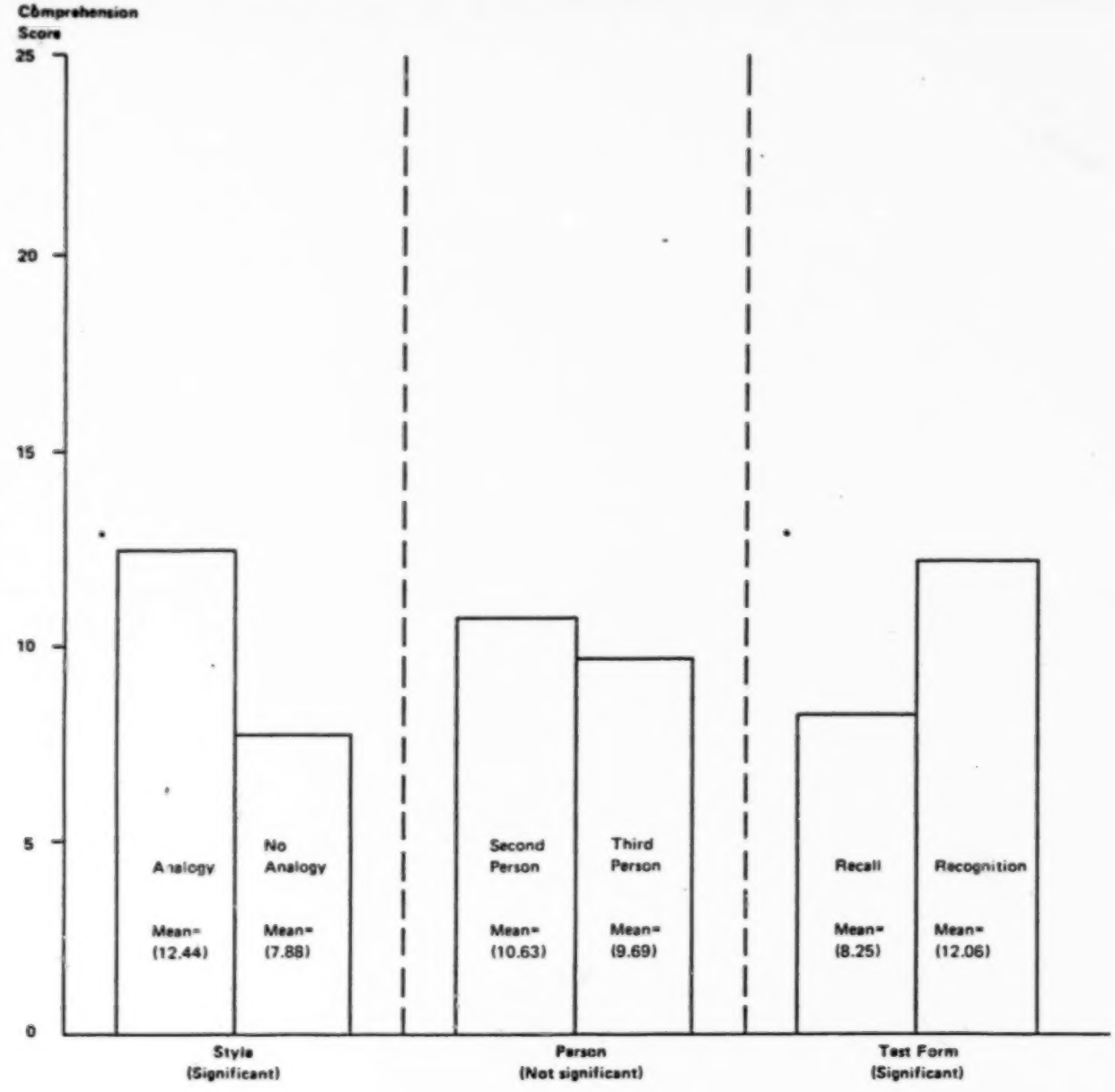
In conclusion, we found no support for the contention that programmers might be hostile to the use of analogy in computer documentation. Programmers seemed to prefer documentation written in second person over that written in third person. Therefore, we conclude that technical writers should consider using analogy and second person to improve the usability of computer documentation. We contend that these stylistic devices do increase comprehension without antagonizing the expert user.

		Place 1	Place 2	Place 3	Place 4
Analogy	1st Person	3	3	3	3
	3rd Person	3	3	3	3
Non Analogy	1st Person	3	3	3	3
	3rd Person	3	3	3	3

Figure 4. Design for Coding Results of First Preference Pre-Test

Recommendation

The fact that we found several strong trends in this very small pre-test encourages us to continue the study. We intend to correct several ambiguities we found in testing the versions and questionnaires and to conduct a larger scale study. We feel that only by repeating the study with much larger samples can we begin to comfortably generalize our results.



*Significant difference, $p < .05$

Figure 5. Experiment 1: Main Effects of Analogy, Person, and Test Form

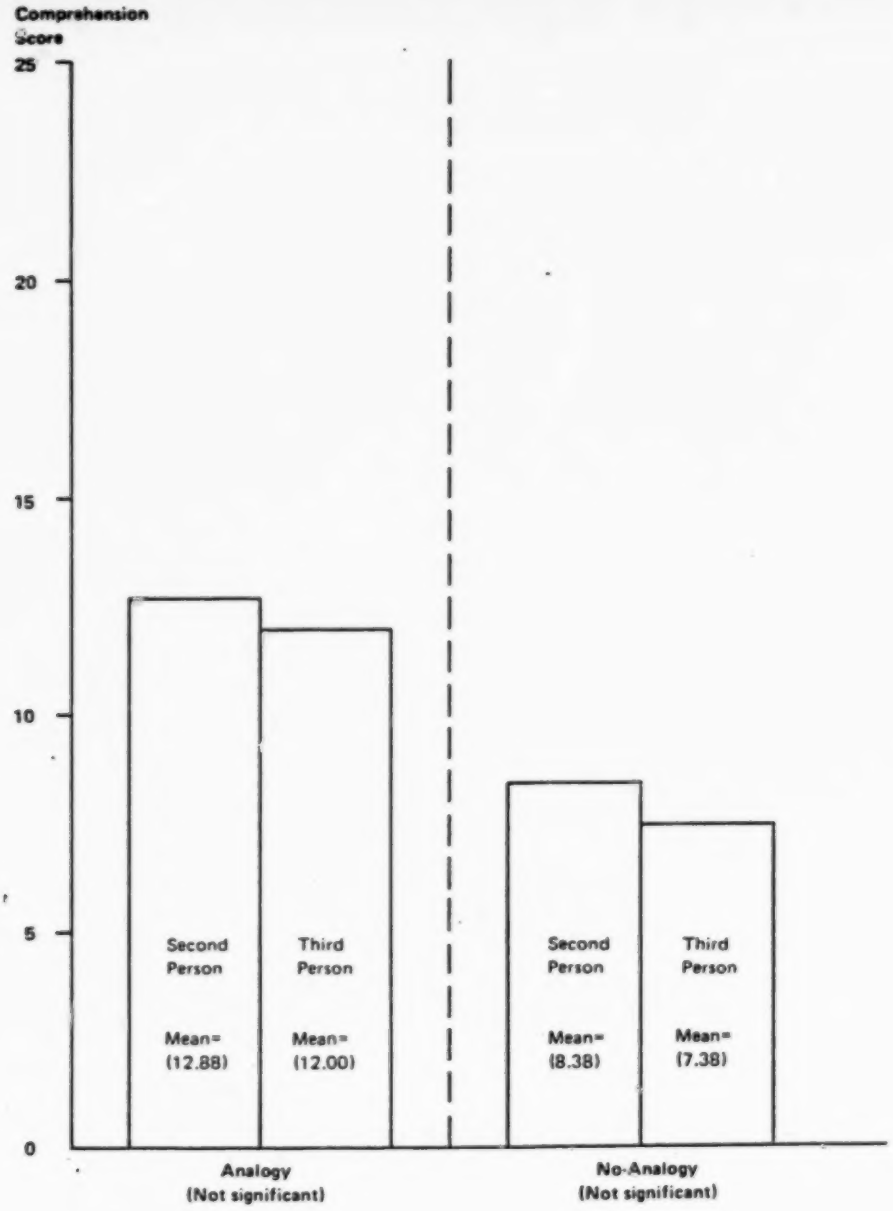
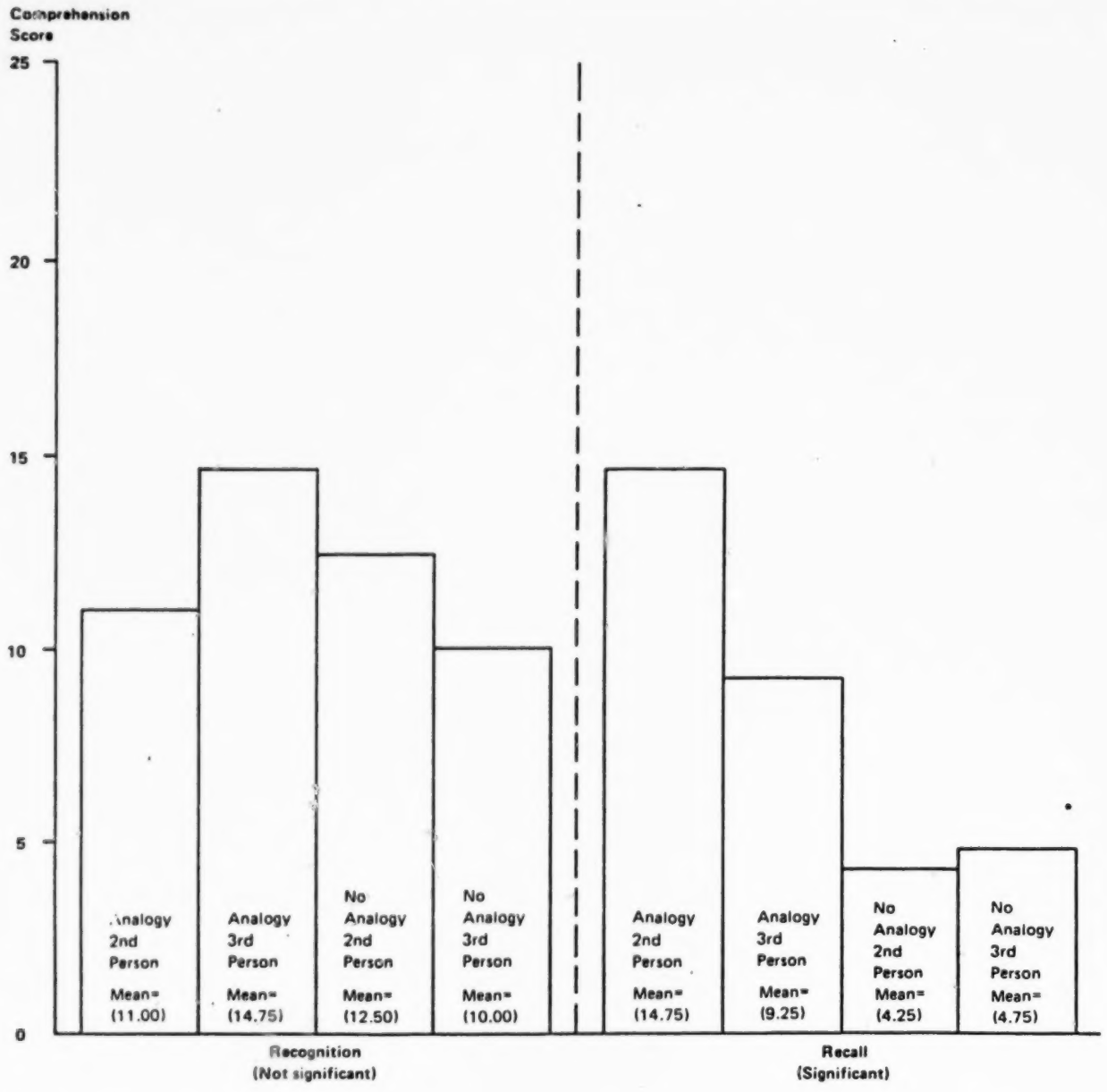
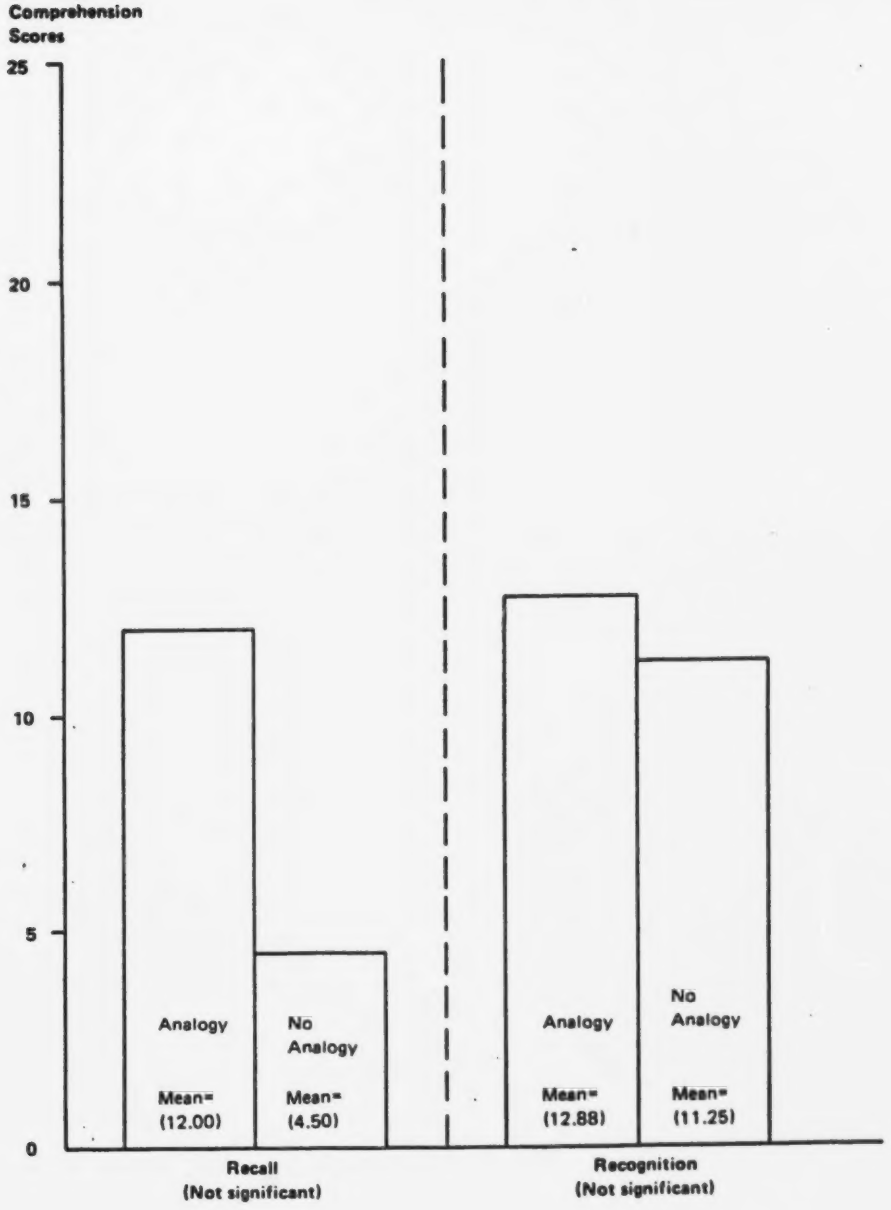


Figure 6. Experiment 1: 2-way Interaction of Analogy and Person



*Significant difference, $p < .05$

Figure 7. Experiment 1: 3-way Interaction of Analogy, Person, and Test Form



Note: Just misses significence, with p = .059.

Figure 8. Experiment 1: 2-way Interaction of Analogy and Test Form

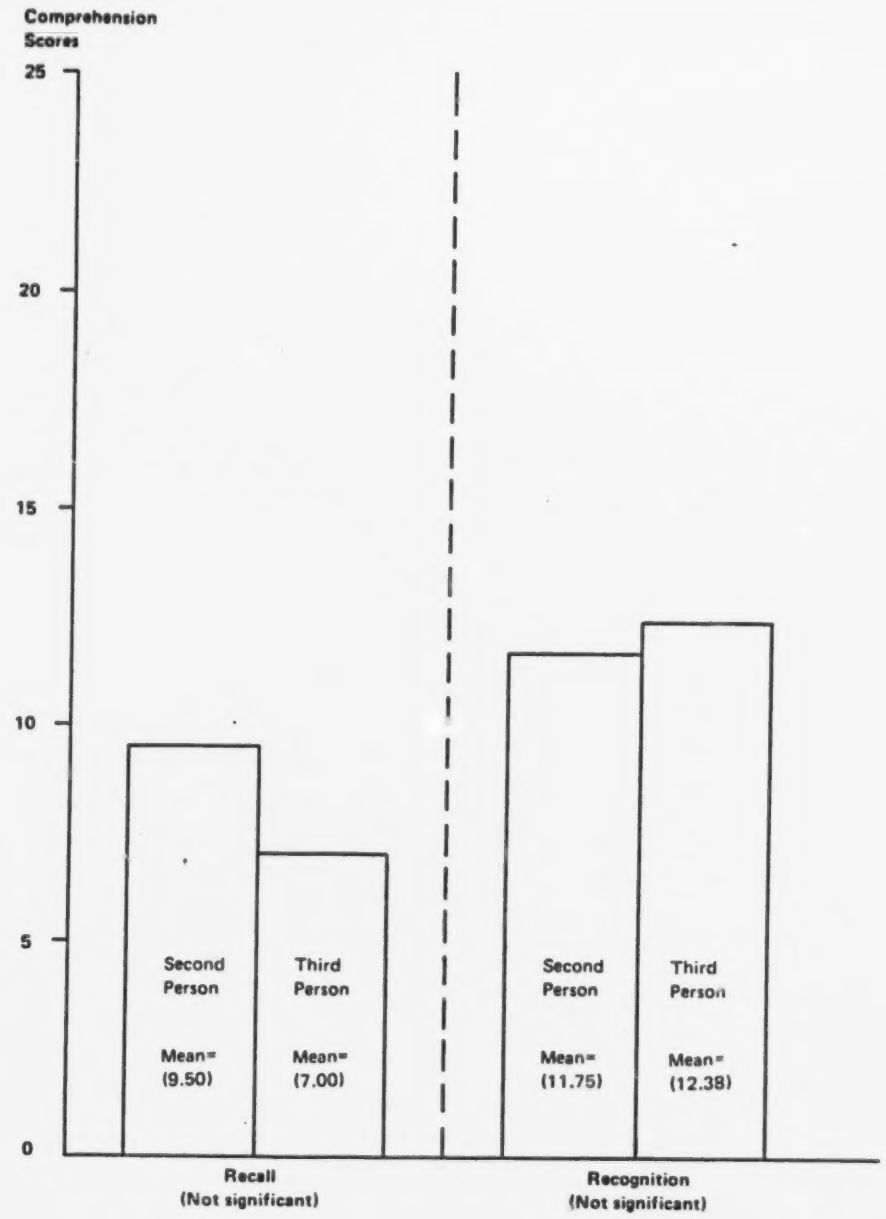
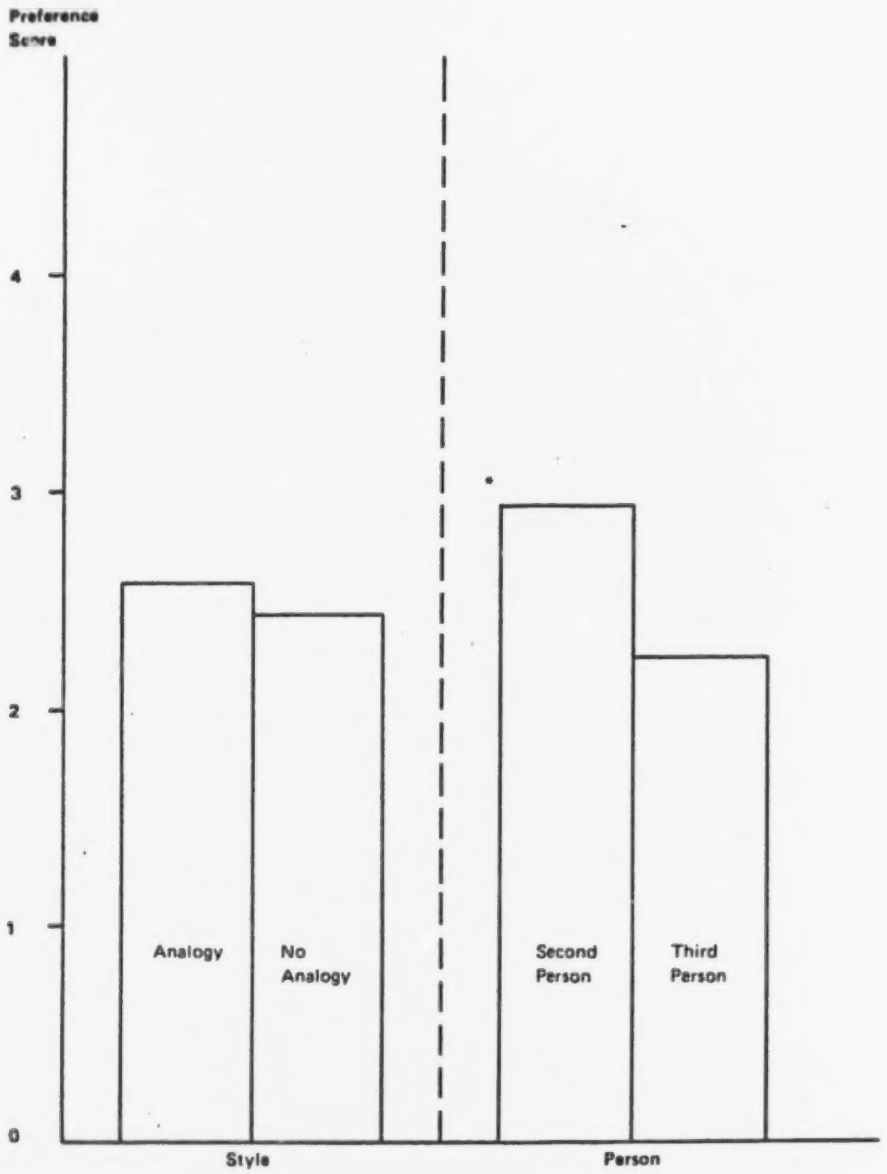


Figure 9. Experiment 1: 2-way Interaction of Person and Test Form



*Significant difference, $p < .05$

Figure 10. Experiment 2: Main Effects of Analogy and Person on Preference

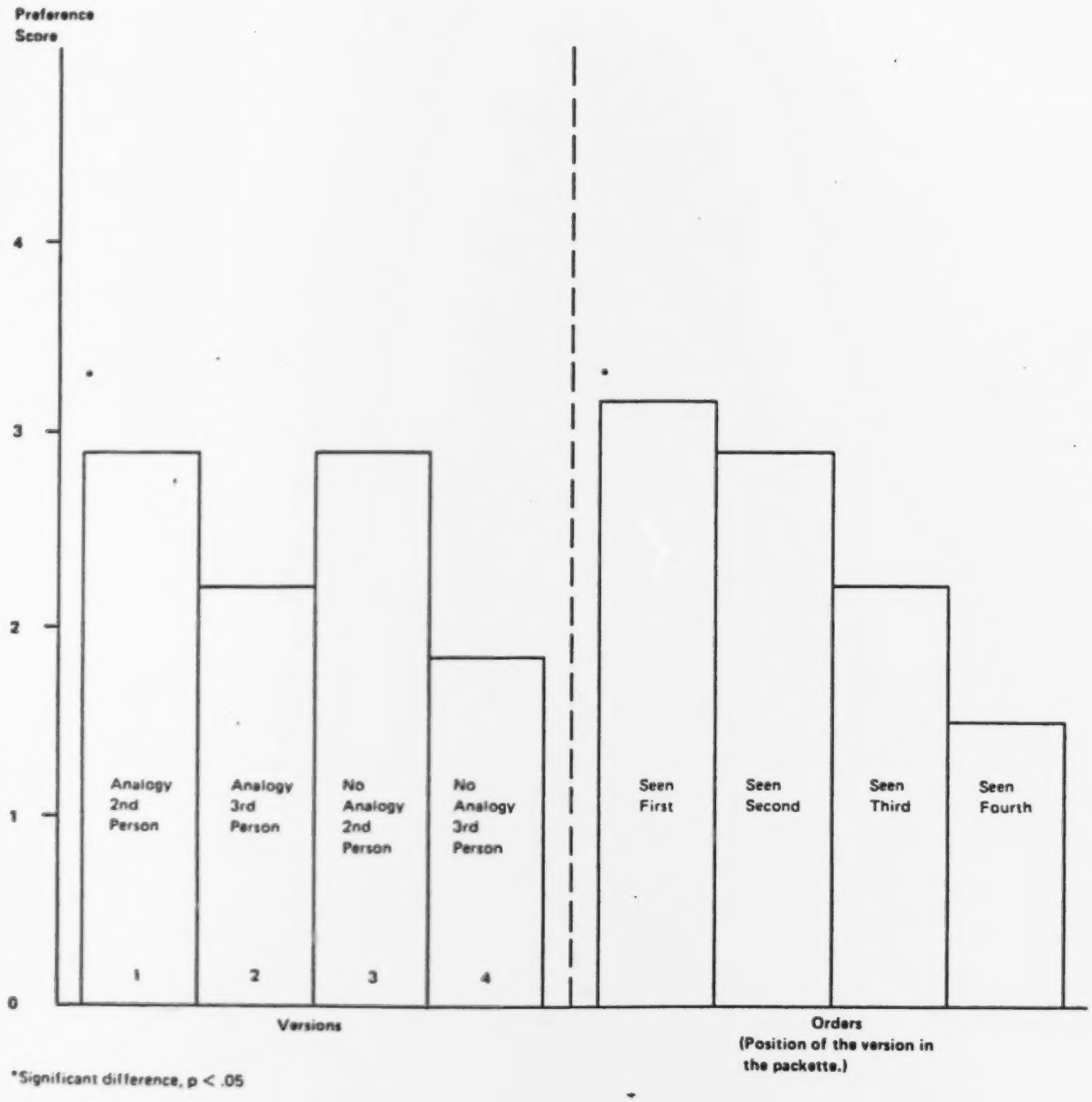


Figure 11. Experiment 2: Effect of Version and Viewing Order on Preference

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APPENDIX A. DOCUMENTATION

VERSION 1

A computer display screen is something like a sheet of paper on a typewriter. As you type letters and numbers on the "typewriter" keyboard, they appear on the display screen. To start typing on a new line, you press the key labeled RETURN, just as you would on a typewriter.

A computer display screen is also something like a window. What you type into a computer doesn't get transferred to separate sheets of paper, as with a typewriter. Rather, you can think of your text as existing on a scroll of paper, more like a Dead Sea scroll than a modern book with separate sheets of paper. The display screen acts like a window through which you can look at your scroll. The window remains stationary but you can move the scroll forward and backward to change your view.

On a typewriter, you use the roller to "scroll" the page forward or backward. On a computer, there are usually Program Function (PF) keys that you can press to scroll the screen forward and backward. There are usually twelve labelled PF keys on a computer keyboard, and these keys are usually located to the right of the "typewriter" keyboard. The key labelled PF1 scrolls the screen forward while the key labelled PF2 scrolls the screen backward.

When you type text and it appears on the display screen, that doesn't necessarily mean that your text has been "written" onto your scroll. Rather, what you type is written onto your side of the window. It is not until you press the key labeled ENTER that your new text "enters" through the window and gets written onto your scroll (in the computer's memory).

Just as there is more than one Dead Sea scroll, you can have many "scrolls" of text. You might want one "scroll" for an English term paper and another "scroll" for a letter to a friend. The computer saves your "scrolls" in separate FILES, just as you would in a filing cabinet at home. You must tell the computer the name of the file in which to store your scroll. The display screen can then be used as a window to look at any one of your files. To do this you must tell the computer the name of the file you want to see.

Some computer display screens can be split into several different windows. That is, you might be able to look at four different files at the same time, for instance, one in the top left quadrant, one in the top right quadrant, one in the bottom right quadrant, and one in the bottom left quadrant. In this case, each quadrant or window operates separately. That is, each window looks onto a separate scroll. You can scroll forward or backward in one file without scrolling forward or backward in the other files. In this way, you could compare four different files to, for example, look at four different chapters of a book at the same time.

The computer unit that you see and work with, which consists of the display screen and the "typewriter" keyboard, is called a TERMINAL. As an airline picks up and discharges passengers at airport terminals, the computer takes in and puts out material at display terminals. With the airlines, the actual travelling takes place

in the air, not at the airport terminal. Similarly, the actual processing and storing of your material doesn't take place at your computer terminal. Rather, your terminal is the end point through which you communicate with the computer.

The airlines tie together a network of cities. As one airplane can take you to many different cities, sometimes one terminal can be used to communicate with several different computers. If your computer is tied together with a number of other computers by a network of communication lines, your terminal could conceivably act as a "port" to any one of them.

In order to communicate with several different computers, your terminal must have a **PORT HOLE** into each. This port hole is a special type of internal definition, or door, that allows your terminal to communicate over the lines to the computer attached at the other end. Your terminal must have a unique defined port hole for each computer with which you want to communicate.

The way that you open a port hole is by **SIGNING ON** to it. Each port hole has its own specific unique sign on code. Like Ali Baba gave the right sign ("Open Sesame") to open the secret door in the mountain, you must give the right sign to open a port hole. Normally, only one port hole can be opened at a time. Therefore, you must **SIGN OFF** to close the opened port hole before you can sign on to another one.

However, if your parent computer has what is called a **SWITCHER** function, you can switch back and forth between sessions with different computers without having to sign off and sign on each time.

The switcher works like a railroad switchman. The railroad tracks leading in different directions do not move, but the switchman sets the ties to send the train along one specific path. Similarly, the switcher on your computer maintains all of the open port holes to the different computers in the network. You sign on only once to the switcher itself and then you can move directly back and forth between port holes and thus save yourself time.

This could be especially useful if you have a display screen that is capable of being split. Through using the switcher, you could see through port holes to different computers at the same time. For instance, on the top half of your screen you could look at a file stored on one computer while at the bottom half of your screen looking at another file stored on a different computer.

VERSION 2

A computer display screen is something like a sheet of paper on a typewriter. As the user types letters and numbers on the "typewriter" keyboard, they appear on the display screen. To start typing on a new line, the user presses the key labeled RETURN, just as he/she would on a typewriter.

A computer display screen is also something like a window. What the user types into a computer doesn't get transferred to separate sheets of paper, as with a typewriter. Rather, the user can think of the text as existing on a scroll of paper, more like a Dead Sea scroll than a modern book with separate sheets of paper. The display screen acts like a window through which the user can look at the scroll. The window stays stationary but the user can move the scroll forward and backward to change the view.

On a typewriter, the roller "scrolls" the page forward or backward. On a computer, there are usually Program Function (PF) keys that the user can press to scroll the screen forward and backward. There are usually twelve labelled PF keys on a computer keyboard, and these keys are usually located to the right of the "typewriter" keyboard. The key labelled PF1 scrolls the screen forward while the key labelled PF2 scrolls the screen backward.

When the user types text and it appears on the display screen, that doesn't necessarily mean that the text has been "written" onto the scroll. Rather, what the user types is written onto the outside of the window. It is not until the user presses the key labeled ENTER that the new text "enters" through the window and gets written onto the scroll (in the computer's memory).

Just as there is more than one Dead Sea scroll, the user can have many "scrolls" of text. There might be one "scroll" for an English term paper and another "scroll" for a letter to a friend. The computer saves the "scrolls" in separate FILES, just as a person would in a filing cabinet at home. The user must tell the computer the name of the file in which to store the scroll. The display screen can then be used as a window to look at any one of the files. To do this the user must tell the computer the name of the file he/she wants to see.

Some computer display screens can be split into several different windows. That is, the user might be able to look at four different files at the same time, for instance, one in the top left quadrant, one in the top right quadrant, one in the bottom right quadrant, and one in the bottom left quadrant. In this case, each quadrant or window operates separately. That is, each window looks onto a separate scroll. The user can scroll forward or backward in one file without scrolling forward or backward in the other files. In this way, the user could compare four different files to, for example, look at four different chapters of a book at the same time.

The computer unit that the user sees and works with, which consists of the display screen and the "typewriter" keyboard, is called a TERMINAL. As an airline picks up and discharges passengers at airport terminals, the computer takes in and puts out material at display terminals. With the airlines, the actual travelling takes place in the air, not at the airport terminal. Similarly, the actual processing and storing of the material doesn't take place at the computer terminal. Rather, the terminal is the <u>end point</u> through which the user can communicate with the computer.

The airlines tie together a network of cities. As one airplane can take people to many different cities, sometimes one terminal can be used to communicate with

several different computers. If the user's computer is tied together with a number of other computers by a network of communication lines, the terminal could conceivably act as a "port" to any one of them.

In order to communicate with several different computers, the terminal must have a **PORT HOLE** into each. This port hole is a special type of internal definition, or door, that allows the terminal to communicate over the lines to the computer attached at the other end. The terminal must have a unique defined port hole for each computer with which the user wants to communicate.

The way that the user opens a port hole is by **SIGNING ON** to it. Each port hole has its own specific unique sign on code. Like Ali Baba gave the right sign ("Open Sesame") to open the secret door in the mountain, the user must give the right sign to open a port hole. Normally, only one port hole can be opened at a time. Therefore, the user must **SIGN OFF** to close the opened port hole before he/she can sign on to another one.

However, if the parent computer has what is called a **SWITCHER** function, the user can switch back and forth between sessions with different computers without having to sign off and sign on each time.

The switcher works like a railroad switchman. The railroad tracks leading in different directions do not move, but the switchman sets the ties to send the train along one specific path. Similarly, the switcher on the computer maintains all of the open port holes to the different computers in the network. The user signs on only once to the switcher itself and then he/she can move directly back and forth between port holes and thus save time.

This could be especially useful if the user has a display screen that is capable of being split. Through using the switcher, the user could see through port holes to different computers at the same time. For instance, on the top half of the screen the user could look at a file stored on one computer while at the bottom half of the screen looking at another file stored on a different computer.

VERSION 3

A computer display screen sits on a table along with a computer keyboard. As you type letters and numbers on the computer keyboard, they appear on the display screen. To start typing on a new line, you press the key labeled RET, located on the right side of the keyboard.

The computer display screen is usually about 9 x 12 inches square. What you type into the computer is stored away so that you can find and use the material again if you want to. The text that you type in is stored as a continuous piece of material. If you have typed in quite a lot of material, you can move backward to see what you typed, for example, an hour ago. You can then move forward, to get back to the place where you ended.

You can move what you see on your display screen forward or backward. On the keyboard, there are usually Program Function (PF) keys that you can press to move the screen forward and backward. There are usually twelve labelled PF keys on a computer keyboard, and these keys are usually located on the right of the computer keyboard. The key labelled PF1 scrolls the screen forward while the key labelled PF2 scrolls the screen backward.

When you type text and it appears on the display screen, that doesn't necessarily mean that your text has been stored. Rather, what you type is just displayed on your screen. It is not until you press the key labeled ENT that your new text is stored away in the computer's memory.

You can use the computer to create many different text documents. For example, you might want to type in an English term paper and then type a letter to a friend. You can do this with the computer by using separate data sets, one for the term paper and one for the letter. You tell the computer to store the different documents in the different data sets. You must tell the computer the name of the data set in which to store your text. You can then call up either of the data sets by name to look at on your display screen.

Some computer display screens can be split into several different sections. That is, you might be able to look at four different data sets at the same time, for instance, one in the top left quarter, one in the top right quarter, one in the bottom right quarter, and one in the bottom left quarter. In this case, each quarter of the display operates separately. That is, each section looks into a separate data set. You can move forward or backward in one data set without moving forward or backward in the other data sets. In this way, you could compare four different data sets to, for example, look at four different chapters of a book at the same time.

The computer unit that you see and work with, which consists of the display screen and the keyboard, is called a TERMINAL. This terminal is an input/output device which means that you can use it to put information into the computer or to get information out. When you are using your terminal, you don't have to be aware that the terminal is communicating with the central computer unit. However, it is the central unit, usually located in another room and even, perhaps, in another building, that actually reads, processes, and stores your material.

Several different computers can be connected together into a "network." Networks of computers are created by attaching each one to the other by communication lines. If

your computer is tied together with a number of other computers by a network of communication lines, your terminal could conceivably be used to communicate with any one of them.

In order to communicate with several different computers, your terminal must have an **LU-TO-LU CONNECTION** with each. This LU connection is a special type of internal definition, that allows your terminal to communicate over the lines to the computer attached at the other end. Your terminal must have a unique defined LU connection for each computer with which you want to communicate.

The way that you make use of the LU connection is by **SIGNING ON** to it. Each LU connection has a specific unique sign-on procedure which it expects of you. In order to be allowed access to a computer through an LU connection, you must type in the correct sign-on information. If the information is correct, you will then be able to use the computer at the other end of the LU connection. Normally, only one LU connection can be used at a time. Therefore, you must **SIGN OFF** of the LU connection you are using if you want to sign on to the LU connection for another computer session.

However, if your parent computer has what is called a **SWR** function, you can go back and forth between LU connections with different computers without having to sign off and sign on each time.

The SWR works in a unique way. The SWR has many more LU connections than a terminal can have. Therefore, the SWR can have several LU connections for each computer in the network, all set up at the same time. Therefore, at any time, the SWR in your parent computer has open ties of communication with the entire network. You sign on only once to the SWR itself and then you can move directly back and forth between LU connections and thus save yourself time.

This could be especially useful if you have a display screen that is capable of being split. Through using the SWR, you could use the LU connections to communicate with different computers at the same time. For instance, on the top half of your screen you could look at a data set stored on one computer while at the bottom half of your screen looking at another data set stored on a different computer.

VERSION 4

A computer display screen sits on a table along with a computer keyboard. As the user types letters and numbers on the computer keyboard, they appear on the display screen. To start typing on a new line, the user presses the key labeled RET, located on the right side of the keyboard.

The computer display screen is usually about 9 x 12 inches square. What the user types into the computer is stored away so that he/she can find and use the material again if so desired. The text that the user types in is stored as a continuous piece of material. If the user has typed in quite a lot of material, he/she can move backward to see what was typed, for example, an hour ago. The user can then move forward, to get back to the place where he/she ended.

The user can move what he/she sees on the display screen forward or backward. On the keyboard, there are usually Program Function (PF) keys that the user can press to move the screen forward and backward. There are usually twelve labelled PF keys on a computer keyboard, and these keys are usually located on the right of the computer keyboard. The key labelled PF1 scrolls the screen forward while the key labelled PF2 scrolls the screen backward.

When the user types text and it appears on the display screen, that doesn't necessarily mean that the text has been stored. Rather, what the user types is just displayed on the screen. It is not until the user presses the key labeled ENT that the new text is stored away in the computer's memory.

The user can use the computer to create many different text documents. For example, the user might want to type in an English term paper and then type a letter to a friend. The user can do this with the computer by using separate data sets, one for the term paper and one for the letter. The user tells the computer to store the different documents in the different data sets. The user must tell the computer the name of the data set in which to store the text. The user can then call up either of the data sets by name to look at on the display screen.

Some computer display screens can be split into several different sections. That is, the user might be able to look at four different data sets at the same time, for instance, one in the top left quarter, one in the top right quarter, one in the bottom right quarter, and one in the bottom left quarter. In this case, each quarter of the display operates separately. That is, each section looks into a separate data set. The user can move forward or backward in one data set without moving forward or backward in the other data sets. In this way, the user could compare four different data sets to, for example, look at four different chapters of a book at the same time.

The computer unit that the user sees and works with, which consists of the display screen and the keyboard, is called a TERMINAL. This terminal is an input/output device which means that the user can use it to put information into the computer or to get information out. When using the terminal, the user doesn't have to be aware that the terminal is communicating with the central computer unit. However, it is the central unit, usually located in another room and even, perhaps, in another building, that actually reads, processes, and stores the material.

Several different computers can be connected together into a "network." Networks of computers are created by attaching each one to the other by communication lines. If

the user's computer is tied together with a number of other computers by a network of communication lines, the user's terminal could conceivably be used to communicate with any one of them.

In order to communicate with several different computers, the terminal must have an **LU-TO-LU CONNECTION** with each. This LU connection is a special type of internal definition, that allows the terminal to communicate over the lines to the computer attached at the other end. The terminal must have a unique defined LU connection for each computer with which he/she wants to communicate.

The way that the user makes use of the LU connection is by **SIGNING ON** to it. Each LU connection has a specific unique sign-on procedure which it expects of the user. In order to be allowed access to a computer through an LU connection, the user must type in the correct sign-on information. If the information is correct, the user will then be able to use the computer at the other end of the LU connection. Normally, only one LU connection can be used at a time. Therefore, the user must **SIGN OFF** of the LU connection he/she is using if he/she wants to sign on to the LU connection for another computer session.

However, if the parent computer has what is called a **SWR** function, the user can go back and forth between LU connections with different computers without having to sign off and sign on each time.

The SWR works in a unique way. The SWR has many more LU connections than a terminal can have. Therefore, the SWR can have several LU connections for each computer in the network, all set up at the same time. Therefore, at any time, the SWR in the parent computer has open ties of communication with the entire network. The user signs on only once to the SWR itself and then he/she can move directly back and forth between LU connections and thus save time.

This could be especially useful if the user has a display screen that is capable of being split. Through using the SWR, the user could use the LU connections to communicate with different computers at the same time. For instance, on the top half of the screen the user could look at a data set stored on one computer while at the bottom half of the screen looking at another data set stored on a different computer.

APPENDIX B. QUESTIONNAIRES

QUESTIONNAIRE 1A: RECALL FOR VERSIONS 1 AND 2

1. You are typing material onto your display screen. How would you move to the next line?

2. You've been typing for five minutes and your screen is full, but you still have more information to type in. What would you do next?

3. You have finished typing and you are now ready to store your text in the computer. What must you do?

4. You want to look at some text that you saved last week. What must you tell the computer if you are to see this text?

5. You would like to look at four files at the same time. What capability would your computer need in order for you to do this?

6. What device does the computer use to take in and put out information?

7. In order for you to communicate with several different computers, your computer display device must have a _____ with each computer.

GO TO NEXT PAGE. DO NOT RETURN TO THIS PAGE.

8. You want to communicate with computer A. How do you open this connection?

9. You have been using computer A. Now you want to use computer B. What must you do?

10. Your computer has a special function which makes it easier for you to go back and forth when communicating with several different computers. What is this function called?

11. Last week you wrote a letter to your congressman and stored it in computer A. You've received a responding letter and it is stored in computer B. You would like to see both letters on your display screen at the same time in order to make sure all your questions have been answered. What two functions must your computer have to make this possible?

STOP. DO NOT GO BACK. TURN IN YOUR ANSWERS.

QUESTIONNAIRE 1B: RECALL FOR VERSIONS 3 AND 4

1. You are typing material onto your display screen. How would you move to the next line?

2. You've been typing for five minutes and your screen is full, but you still have more information to type in. What would you do next?

3. You have finished typing and you are now ready to store your text in the computer. What must you do?

4. You want to look at some text that you saved last week. What must you tell the computer if you are to see this text?

5. You would like to look at four data sets at the same time. What capability would your computer need in order for you to do this?

6. What device does the computer use to take in and put out information?

7. In order for you to communicate with several different computers, your computer display device must have an _____ with each computer.

GO TO NEXT PAGE. DO NOT RETURN TO THIS PAGE.

8. You want to communicate with computer A. How do you open this connection?

9. You have been using computer A. Now you want to use computer B. What must you do?

10. Your computer has a special function which makes it easier for you to go back and forth when communicating with several different computers. What is this function called?

11. Last week you wrote a letter to your congressman and stored it in computer A. You've received a responding letter and it is stored in computer B. You would like to see both letters on your display screen at the same time in order to make sure all your questions have been answered. What two functions must your computer have to make this possible?

STOP. DO NOT GO BACK. TURN IN YOUR ANSWERS.

QUESTIONNAIRE 2A: RECOGNITION FOR VERSIONS 1 AND 2

1. What is the RETURN key on the computer keyboard used for?

2. What happens when you press the PF1 key?

3. What is the ENTER key used for?

4. What is a FILE?

5. What does the SPLIT SCREEN capability allow you to do?

6. What does a computer need a TERMINAl for?

7. What is a PORT HOLE?

8. What is a SIGN-ON?

9. What is a SIGN-OFF?

10. What does the SWITCHER function do?

11. If you were using both the SPLIT SCREEN and the SWITCHER at the same time, what would you be doing?

STOP. TURN IN YOUR ANSWERS.

QUESTIONNAIRE 2B: RECOGNITION FOR VERSIONS 3 AND 4

1. What is the RET key on the computer keyboard used for?

2. What happens when you press the PF1 key?

3. What is the ENT key used for?

4. What is a DATA SET?

5. What does the SPLIT SCREEN capability allow you to do?

6. What does a computer need a TERMINAl for?

7. What is an LU-to-LU CONNECTION?

8. What is a SIGN-ON?

9. What is a SIGN-OFF?

10. What does the SWR function do?

11. If you were using both the SPLIT SCREEN and the SWR at the same time, what would you be doing?

STOP. TURN IN YOUR ANSWERS.

QUESTIONNAIRE 3: PREFERENCE

Please read the attached four versions of computer documentation and then rank order them according to your preference:

1. First choice (best version): _____
2. Second choice (2nd best): _____
3. Third choice: _____
4. Last choice (worst version): _____